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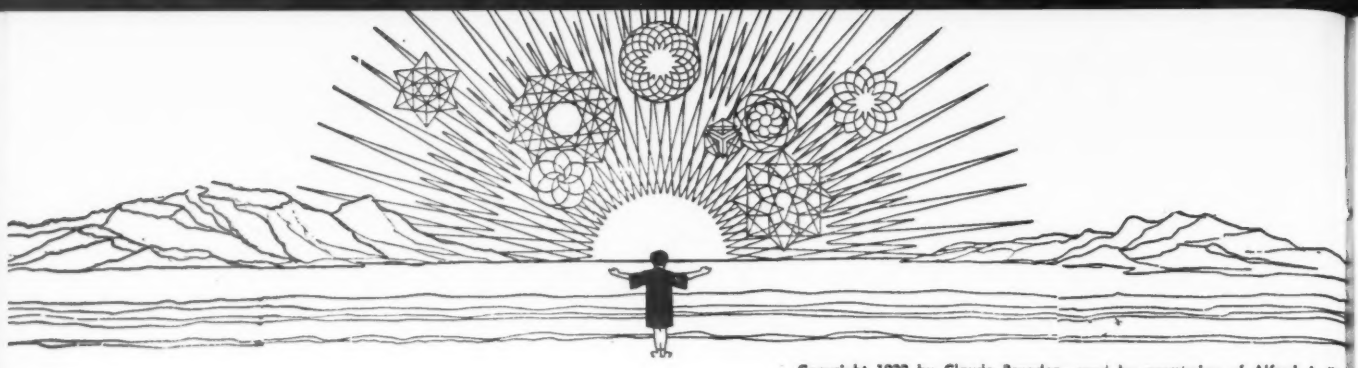

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MAIN CURRENTS
IN MODERN THOUGHT

A cooperative journal to promote the free association of those working toward the integration of all knowledge through the study of the whole of things, Nature, Man, and Society, assuming the universe to be one, dependable, intelligible, harmonious.

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On the cover: Photograph of a Solar Prominence through the courtesy of the Sacramento Peak Observatory, Geophysics Research Directorate, AFCRC.

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MAIN CURRENTS IN MODERN THOUGHT is published to call attention to significant contributions to learning currently being made in the multiple fields, relating these advances to each other and to classical and contemporary views of Eastern, European and American thinkers. It is designed to save time for the reader by providing a vantage-ground from which the whole world of knowledge may be surveyed and kept in proportion as it moves toward integration. Its editors assume that the principles of art, the universals of philosophy, the laws of Nature and Man as formulated by science, and the truths of comparative religion, can be orchestrated into a harmonic, meaningful, ethical body of teachings which can and should be made the central core of curricular study in the educative process at all levels. Contributors to MAIN CURRENTS enjoy full liberty of opinion and expression in these pages.

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WOLFGANG PAULI'S PHILOSOPHICAL VIEWS

W. Heisenberg

Translated by Kurt Leidecker

WOLFGANG PAULI'S contributions to theoretical physics permit only in a few passages a glimpse of the philosophical background on which he has established them. To his colleagues, Pauli appears first and foremost as the brilliant physicist, always endeavoring to be most precise in his expressions, the physicist who has decisively influenced and enriched the physics of our century by his significant and novel ideas, by his analysis of existing knowledge which is lucid to the very last details, and by his unsparing criticism of all vagueness and inaccuracy in theories that scientists proposed.

Were we to construe Pauli's basic philosophical position on the strength of his natural science statements, we would, at first, be inclined to arrive at the conclusion that he professes an extreme rationalism and espouses a skepticism with respect to principles. In reality, however, a deep philosophical interest was hidden behind his ostentatious critical attitude and skepticism, an interest which extended even to the obscure realms of reality or the human psyche inaccessible to reason. The vigorous fascination which Pauli's analyses of the physical problems have exerted was, probably, due in part to the perspicacity of his formulations which he carried into the finest details, and in part also to his constant contact with the realm of spiritual and productive processes which have not been formulated rationally as such. Indeed, Pauli went very early all the way along the well-known rationalism-inspired skepticism until he consequently arrived at skepticism about skepticism. Then he attempted to trace the elements of the process of knowledge which precede rational penetration.

TWO papers in particular furnish us with the essentials of Pauli's philosophical attitude: A treatise on the influence of archetypal ideas on the formulation of natural science theories in Kepler(1) and a lecture on science and thought in the Western world(2). We shall attempt to draw a picture of Pauli's philosophical position from these two testimonials and from statements in letters and elsewhere.

As a first and pivotal problem of philosophical reflection, Pauli recognized the process of knowledge itself, especially knowledge of nature which ultimately finds its rational expression in the establishment of mathematically formulated natural laws. Pauli was not satisfied with the concept of pure empiricism according to which the natural laws may solely be derived from the matter of experience. Rather, he concurred with those who "emphasize the role of the direction of attention and intuition in the concepts and ideas which, in general, transcend by far mere experience, but are necessary for establishing a system of natural laws (i.e., a scientific theory)." He thus sought a connection between the perception of the senses on the one hand, and concepts on the other: "All rigorous thinkers arrived at the conclusion that pure logic is, in principle, incapable of constructing such a connection. The most satisfactory procedure seems to be to introduce in this place the postulate of a cosmic order removed from human arbitrariness, an order which differs from the world of appearance. Whether we speak of a 'participation of the things of nature in the ideas' or of a 'behavior of metaphysical, i.e., real things in themselves,' the relation between sensuous perception and idea remains as the consequence of the fact that the psyche as well as that which is known in perception are subject to an order we think of as objective."

The bridge which leads from the material of experience, which at first is in a state of lack of order, to the ideas, Pauli discerns in certain primary images pre-existing in the psyche, the archetypes as they have been discussed by Kepler and even in modern psychology. These primary images —Pauli here follows to a large extent the thoughts of C. G. Jung—should not be looked for in consciousness or related to certain ideas which may be formulated rationally. We are concerned, rather, with the forms of the unconscious realms of the human psyche, with images of a strongly emotional content, which are not being thought out but are seen, as it were, while we paint them. The

feeling of joy at becoming aware of a new knowledge arises from the fact that such pre-existing primary images are in process of achieving congruity with or coincidence with the behavior of external objects.

As is well-known, this view concerning the knowledge of nature goes back essentially to Plato and has penetrated Christian thinking by way of Neoplatonism (Plotinus, Proclus). Pauli attempts to make it clear by demonstrating that even in Kepler's acknowledgment of the Copernican theory which forms the beginning of modern natural science, certain primary images, archetypes, were decisively present. He quotes from Kepler's *Mysterium Cosmographicum* this sentence: "The likeness of the triune God is contained in the sphere, that is to say, of the Father in the center, of the Son in the surface, and of the Holy Ghost in the symmetry of the relation between point and interstice or circumference." The movement from center to surface is, for Kepler, the symbol of creation. This symbol which is most intimately connected with the Holy Trinity and which is designated by C. G. Jung as *mandala,* is, for Kepler, imperfectly realized in the corporeal world: The sun at the center of the planetary system is orbited by the heavenly bodies which were yet thought of by Kepler as animated. Pauli believes that the persuasive power of the Copernican system, in the case of Kepler, was due primarily to the correspondence with the mentioned symbol and only secondarily to the matter of experience.

More than that, Pauli thinks that Kepler's symbol in very general terms stands for the attitude out of which today's natural science grew. "It seems that the psyche moves in the sense of an extraversion from an inner center towards the outside, the corporeal world, in which all events are automatic by presupposition so that the spirit at rest embraces, as it were, this corporeal world with its ideas." We are, thus, dealing with a Christian development of the "lucid mysticism" of a Plato in the natural science of the present day. We are looking for the unitary ground of spirit and matter in the primary images, and in this Platonic mysticism the understanding has found a proper place in its different degrees and kinds of knowledge up to the recognition of the truth of salvation. However, Pauli adds by way of a warning: "This mysticism is so lucid that it sees beyond many dark areas, a thing we, today, neither ought to nor can do."

Thus he contrasts the basic position of Kepler with that of his contemporary, the English physician Fludd, with whom Kepler was engaged in a violent polemics over the application of mathematics to experience refined by quantitative measurements. Fludd here turned out to be a representative of an archaic, magical description of nature as it was engaged in by medieval alchemy and the secret societies that developed from it.

The further development of Plato's thought led Neoplatonism and in Christianity to the characterization of matter as absence of ideas and its identification with evil, since the intelligible was considered identical with the Good. The World Soul, however, was finally replaced in modern natural science by the abstract mathematical law of nature. With respect to this one-sided spiritualizing tendency, alchemical philosophy, represented in this case by Fludd, offered a certain counterweight. According to the alchemical view "a spirit dwells in matter who waits for his salvation. The alchemical experimenter is always drawn into the course of nature suchwise that the real or imagined chemical processes in the retort are mystically identified with the psychical processes taking place within himself and are designated by the same terms. The salvation of matter by man who transforms it—the salvation which culminates in the production of the Philosopher's Stone—is, in the alchemical conception, in consequence of the mystical correspondence of macrocosm and microcosm, identical with the transformation which spells the salvation of man, a transformation by the *Opus* which is effected only *Deo concedente.*" For this magical view of nature the predominant symbol is the number four, the so-called tetractys of the Pythagoreans which is constructed by means of two polarities. Division is attributed to the dark side of the world (matter, the devil), and the magical conception of nature encompasses even this dark realm.

None of these two lines of development which took their rise, on the one hand, with Plato and the Christian philosophy, and medieval alchemy on the other, could later escape disintegration into opposite thought systems. Platonic thought, which was originally directed towards the unity of matter and spirit, eventually led to a cleavage into the scientific and religious world image, while the spiritual movement determined by gnosis and alchemy brought forth, on the one hand, scientific chemistry and, on the other, the religious mysticism dissociated once again from the material process (e.g., Jakob Boehme).

PAULI recognizes these divergent spiritual lines of development which, nevertheless, belong together, as complementary relationships which have determined occidental thought and which to us moderns are more easily intelligible than to earlier epochs since the logical possibility of such relationships has become perspicacious through quantum mechanics. In thinking scientifically, as is characteristic in a special manner of the Western world, the psyche turns outward; it asks for the why. "Why does the One mirror itself in the Many; what is the thing mirroring, and what is the mirrored; why did not the One remain alone?"

Contrariwise, mysticism which is at home equally in the East as in the West attempts to experience the

unity of things in that it tries to expose multiplicity as illusion. The endeavor to know scientifically has led in the 19th century to the limiting conception of an objective material world independent of all observation. At the terminal point of mystical experience we have as limiting condition the soul, completely dissociated from all objects and united with the deity. Between both limiting ideas the thought of the West stretches, as it were, according to Pauli. "In the soul of man both attitudes will dwell forever, and the one will ever carry the other as the germ of its opposite within itself. Thus there arises a sort of dialectical process of which we cannot know where it will lead us. I believe that, as Westerners, we must commit ourselves to this process and acknowledge the opposite pair as complementary. In that we allow the tension of the opposites to exist, we must also acknowledge that on every path of knowledge or salvation we are dependent on factors beyond our control and which the language of religion has always designated as grace."

When, in the spring of 1927, the reflections on the interpretation of quantum mechanics assumed their rational shape and Bohr coined the concept of complementarity, Pauli was one of the first physicists who, without reservation, decided in favor of the new possibility of interpretation. Pauli's philosophical position naturally corresponded to the characteristic features of this interpretation, the belonging together of "choice and sacrifice." What we mean by this is that in every experiment, in every operative interference in nature, we have the choice which side of nature we wish to make apparent, but that simultaneously with it we have to make a sacrifice, that is, relinquish other aspects of nature. In all this there was always at the center of Pauli's philosophical thinking the longing for a unified understanding of the world, a unity which could absorb the tensions of opposites, and he hailed the interpretation of the quantum theory as a new thought possibility in which, perchance, the unity could be more easily interpreted than had been the case previously. In alchemical philosophy he was captivated by the attempt to talk about material and psychical processes in the same language. Thus Pauli arrived at the thought that in the abstract region which both atomic physics and modern psychology have entered upon, such a language could once again be found. "I suspect, to be sure, that the alchemical attempt at a psycho-physical common language suffered defeat only because it bore reference to a visible, concrete reality. But today we have, in physics, an invisible reality (of atomic objects) in which the observer becomes involved with a certain freedom (wherein he is put before the alternative 'choice and sacrifice'). In the psychology of the unconscious we have processes which cannot always be attributed unambiguously to a certain subject. Now, the attempt at a psycho-physical monism appears to me essentially more fruitful if the common language has reference to a deeper, invisible reality. That language is, of course, not yet known and would be psycho-physically neutral with respect to the pair of opposites. We would then discover a mode of expression for the unity of all being transcending the causality of classical physics in the sense of a correspondence (Bohr). The psycho-physical connections and the correspondence of the *a priori* instinctive forms of ideation with the external perceptions would be special cases of this mode of expression. In this conception the traditional ontology and metaphysics would become the sacrifice, while the choice would fall on the unity of being."

Of special studies in which Pauli was stimulated by the philosophical treatises just discussed, principally those on the symbolism of the alchemists have left lasting traces which may be recognized on occasion in opinions expressed in his letters. For instance, in the theory of elementary particles he waxes enthusiastic over the different four-term symmetries interlaced with each other which he immediately relates to the tetractys of the Pythagoreans. Again, he writes: "Bipartition and reduction in symmetry, that is the core of the matter (*des Pudels Kern*). Bipartition is a very old attribute of the devil (the word doubt is supposed to have meant originally division into two)."

Pauli was less close in thought to the philosophical systems dating from the time after the Cartesian cleavage. Kant's employment of the concept *"a priori"* he criticizes in most definite terms, since Kant used this technical expression for forms of intuition or forms of thought which are capable of rational fixation. He warned expressly that "one should never explain theses established by rational formulation as the only possible presuppositions of human reason." The *a priori* elements of natural science, however, Pauli relates most intimately to the primary images, the archetypes of Jung's psychology which do not necessarily have to be understood as innate, but which may be conceived as slow variables and relative to a given knowledge situation. In this respect, therefore, Pauli's and C. G. Jung's concept is different from that of Plato, who looked upon the primary images as unchangeable and existing independently of the human soul. At any rate, these archetypes are, however, the consequences or witnesses of a general order of the cosmos which comprises matter and spirit equally.

In view of this unitary order of the cosmos which, for the present, may not be formulated rationally, Pauli is skeptical also about the Darwinian conception so widely held in modern biology, according to which the evolution of the species on earth is supposed to have originated solely by accidental mutations and their effects in conformity with the laws of physics and chemistry. He feels that this schematism is too narrow

and thinks that more general connections are possible which can neither be incorporated into the general conceptual schematism of causal structures nor described correctly by the concept "chance." Again and again we meet in Pauli the endeavor to leave the modes of thinking we are used to in order to approach the understanding of the uniform structure of the world along new paths.

Moreover, we need not mention that Pauli had to enter again and again the debate with himself regarding the concept of God while struggling for a correct understanding of the "One," and if he writes in a letter of the "theologians with respect to whom I stand in the archetypal relation of hostile brothers," this remark surely was likewise meant in earnest.

AS little as he was capable of simply living and thinking in the tradition of one of the old religions, so little was he prepared to align himself with an atheism founded naively on rationalism. Perhaps one cannot present Pauli's attitude in these very general problems any better than he himself has done in the concluding paragraph of his lecture on science and thinking in the Western world: "However, for the person to whom narrow rationalism has lost its convincing power, and the magic of a mystical attitude which experiences the external world in its oppressive manifoldness as illusory is not effective enough, for such a person, I believe, nothing remains but to expose himself to these contrasts and their conflicts, in one way or another. It is just for that reason that the investigator can, more or less consciously, pursue an inner path of salvation. Then there arise, slowly, compensatory to the external conditions, inner images, imaginings or ideas which show that an approximation of the poles of the pair of opposites is possible. Having been warned by the failure of all premature endeavors in the history of the humanities toward unity, I do not intend to venture predictions as to the future. But, contrary to the strict division of the activity of the human mind into separate compartments, fashionable since the 17th century, I consider the ideal goal of surmounting the opposites, to which also the synthesis which emphasizes rational understanding as well as the mystical experience of unity belongs, as the mythos of our modern times, be it plainly stated or tacitly held."

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MAIN CURRENTS is privileged to publish the above article by Prof. Heisenberg for the first time in English translation, approved by the author, through the kindness of J. Springer-Verlag, publishers of the journal, *Die Naturwissenschaften,* in whose December 1959 issue the article first appeared.

ORGANIZATION AND MIND IN EVOLUTION

Alfred Taylor

A Biochemist Considers the Concept that Mind as Reflected in the Organization or Design of Structures and Events Is the Essential Reality in Nature

THE impact of the concept of evolution on man's ideas about the universe has been most dramatic. This is especially so now that scientific knowledge has extended the application of the principle of evolution to include both the inorganic and organic aspects of nature. The idea of evolution forces us to think of the universe as developing from relatively undifferentiated matter and energy through successive levels of organization. It implies that the diverse phenomena of nature are expressions of an underlying unity in law and essence.

There has been much speculation on how all this has come about. The prevailing hypothesis is that evolution has proceeded on the basis of the random action of undirected natural forces and laws. However, if we consider the subject of evolution with due regard to scientific knowledge and human experience we arrive at an entirely different conclusion.

From the standpoint of inorganic evolution, the evidence available to us indicates that, to use Gamow's words, "the universe as we know it must have originated a few billion years ago from hot homogeneous ylem—which differentiated in the process of the expansion of the universe." The term ylem refers to the elementary particles of subatomic physics. According to Einstein's theory of relativity this process of differentiation occurred in a continuum of space and time which ideally existed as a smooth unruffled expanse but which, in connection with the gravitational fields and other forces associated with material aggregates, became subjected to irregular stresses. Hence, in picturing the evolvement of the universe a homogeneous field of matter and energy is transformed into heterologous systems which, as they grow, become more diverse and continually change the pattern of forces in space. The universe is dynamic whether at the level of force fields, elementary particles, or at the level of a galaxy. There is the dimension of time as well as the three dimensions of space. The total universe, according to Einstein's theory, is a unified system of matter and energy and since it is diverse in structure and action, it follows that every point in it must be unique just by virtue of the factor of position. For example, this is obviously so for points within our solar system on the basis of gravitational forces alone, and electromagnetic forces are similarly affected. There are certain consequences of this concept of the universe which appear to be self-evident and which have important theoretical implications.

IF the universe begins with undifferentiated matter and energy, then the unthinkable diversity of nature is the result of organization which proceeds by complete steps or unitary gradations. Even at the level of microphysics Planck's constant tells us that radiant energy emerges in discontinuous emissions which are termed quanta. From this it follows that the changes in organization which result in these quanta of radiant energy must be discontinuous also. Throughout nature we have this phenomenon of change from one integrated unit of organization to another. The matter and energy of a particular chemical element are a completely organized system and the change to the atom of the next element in the ascending scale utilizes the design of the previous element but goes on to form a new pattern of matter and energy. The same principle is manifested in the morphology of living substance. A cell is an integrated whole, tissues develop from cells, and tissues in turn are woven into the design of organs and organ systems, finally culminating in the organization of the total animal or plant. As at the level of microphysics the evidence of discontinuity is exemplified by Planck's constant, there is throughout nature, as we know it, the discontinuity of organization in systems of matter and energy.

The universe in all its complexity is built up from a common basic material source by means of diverse levels or organization. We are familiar with this in human experience. All sorts of machinery and other artifacts can be built from the same raw materials. The differences in these products result from differences in design or organization.

It is interesting to note that Einstein's concept of the universe makes diversity of structure and

event a logical necessity. In accordance with the principle mentioned above, the forces impinging on a system of matter and energy must have a relative specificity because of position in time and space. Hence evolvement of matter and energy must proceed under different conditions in different places. This characteristic of the universe, which is deducible from Einstein's theory of relativity, would be most evident where relatively high organizational levels, indicating much time, were concerned, such as we have in living organisms. It is well-known that of the countless billions of leaves on the trees, no two are exactly alike. Individual specificity has also been shown at the much lower level of design of ice crystals or snowflakes. We can assume that this principle of the individuality of systems of matter and energy is universal, though not necessarily discernible in states of matter such as the atomic and subatomic levels where we depend upon mathematical deductions for our information. It appears that the term evolution is equivalent to the progressive increase in differentiation of the organization of structure and event, and so the most highly evolved as far as we know, man himself, is the most individualistic in body and behavior.

Another important aspect of nature is the difference in time values at various levels of organization. A mineral, for example, appears to change very little whereas a living organism changes rapidly. We might say that a mineral has relatively much space and little time, and the animal, relatively little space and much time. Also, since we ourselves are in the animal time category, our opportunities of appreciating inorganic time levels are limited. We can assume on the basis of an evolving nature that if time lapse photography could contract millions of years into a few minutes it would show the diamond, for example, to be much more subject to transformation than would otherwise be anticipated. Astronomers with the panorama of the heavens before them are assured that even the inconceivably massive aggregations of matter and energy which make up the stellar systems are transitory phenomena. Blue stars are considered to be very young, and as Professor W. J. Luyten has stated, "the evidence is slowly accumulating . . . that . . . white dwarfs . . . represent the last stage of a star's decline into obscurity and oblivion." A human body goes through the stages of conception, development, birth, growth, maturity, senility and death. This sequence seems to prevail in general at all levels of the universe. In the instance of a plant or animal, seeds or germ cells provide summaries of information from which a new generation may arise. On the basis of the other uniformities which prevail in nature, we can reasonably speculate that something comparable to this is in effect where a solar system, a galaxy or a universe is concerned. The data of science support the principle of the conservation of matter-energy, and in the animal and plant kingdoms, we have the conservation of information relating to the organization of structure and function. This, too, may be a general principle in nature.

Finally, there is another universal quality that characterizes the course of evolution which needs to be kept in mind if we are to assess the theoretical implications of human knowledge in this field. We have already considered the fact that, in nature, evolvement means the establishment of ascending levels of organization and that this occurs discontinuously. Hydrogen and oxygen, for example, represent particular organizational units of matter and energy. Under certain conditions these two elements unite to form water, a matter and energy system the organization and properties of which are new and independent with respect to the source elements. The point to be emphasized is that each such advance in organization is not only discontinuous but unpredictable on the basis of the organization and qualities of that which preceded it. This principle of unpredictability is observed with great emphasis in the development of living organisms, but is clearly evident also in association with inanimate matter.

WITH this brief summary of some of the basic principles of evolution as revealed to us by scientific evidence and Einstein's concept of the universe, the question arises as to the agent which guided the forces of nature so that the dispersed precursors of atomic matter could be built up into ever higher levels of organization. It is obvious that the essential element in evolution is organizational development. Hence, any speculation on how evolution has occurred must be pinned down to this factor. What do we mean when we designate a particular arrangement of materials and energies as being organized? We will agree that for a human observer the difference between a random assortment of materials and events and organized materials and events is that the one is meaningless and the other has meaning or conveys information. In other words, organization or design reflects something akin to mind or intelligence and occurs only in association with intelligent direction of appropriate forces. On what basis do we decide that the quality of intelligence or mind is present in human affairs? It is apparent that we evaluate a person in this respect by the quality of his actions and words. If there is order, meaning or information in what he says and does, we recognize the presence of mind. If his words and actions are at random with no design or purpose evident, then we conclude intelligence is lacking. Also, when we observe order in aggregations of materials, we know there has been intelligently directed action, human or otherwise. The organized materials which form a bird's nest have meaning or information, but the same materials in a haphazard pile are relatively meaningless. We observe this transformation of disorder into order

wherever intelligent creatures react with the nonliving elements of their environment.

In human experience, then, organization is the product of intelligence, so if we are to harmonize our theories with verifiable knowledge then we may assume that organization in nature is also the product of intelligence, and that the course of evolution, which consists of the development of progressive order in structure and actions, is a reflection of something in the category of mind. Further, since scientific knowledge implies that the diversity of nature is an expression of an underlying unity in law and essence, then it follows that it is a universal intelligence or mind which is expressed in the organization of the universe and in all its subdivisions. We acknowledge intelligence in association with the organization of matter of the cerebral cortex of man and the higher animals. But the brain is linked by a chain of lesser orders of matter and energy to the elementary particles of nuclear physics. Further, whenever we are able to duplicate an organization of matter and energy which exists in nature it requires intelligently directed actions. The chemist is able to synthesize some of the compounds which occur naturally in association with an animal's internal functioning, but in order to do so he engages in carefully supervised procedures. Are we to assume that a chemical compound can develop by random reactions in nature but requires intelligence when it is synthetized in a laboratory? Neither the data of science nor ordinary human experience offers any support for the idea that organization can arise without intelligent supervision of the forces and conditions which bring it about.

The idea that the universe is an expression of a universal intelligence appears to be as old, at least, as the recorded history of human thinking. But what we are proposing links this concept with the design of systems of matter and energy. In other words, matter and mind are assumed to be aspects of a common reality. Obviously any manifestation of the wisdom of nature must come to us through material organization. We have the same problem in communicating with each other. Words in the form of sound or letters written on paper can be organized so that we can pass information from one person to another. In a more limited manner, meaning comes to us from the behavior of a pet dog or cat. We know our environment only through designs which give us information that harmonizes with our intelligence. Wherever we turn our attention, these communications are present for our deciphering. If they were not the product of something akin to our own minds, they would be meaningless. No science would be possible in a mindless universe.

THE only way it is possible to defend the materialistic hypothesis is to follow a procedure which, plausible as it may seem, is completely without justification, and that is to reason back from a present level of organization to the one which preceded it. In this way we eliminate the problem of how the forces were directed in order to achieve the present status. We bypass a vital aspect of the processes of evolvement. This can be shown by considering the example of a man building a house. Once the house is completed it is possible to analyze the sequence of events in its construction and to demonstrate that every step was in accordance with engineering principles. Moreover, we could reason that the house was the result of a number of mechanically determined steps: each nail was in place because of the impact of a hammer powered by muscular action, and so on. From the initial preparation of materials to the finished product, everything proceeded in accordance with natural laws. But the flaw in such analysis is that it leaves out the directive intelligence without which, in human experience, no meaningful design is possible. Naturally, if the structure is already completed the guidance of the forces utilized in the work is no longer necessary. If we walk through the woods in search of a particular location there is continuous attention to direction. Finally we come to the place we have been seeking. Now we can trace back our path and in doing so the supervision of direction can be dispensed with. If we reason from the present to the past, the problem of the direction of forces in evolution ceases to exist. We are beginning with the end product which is connected to anterior states by a single undeviating span of consequences. By this procedure we can argue ourselves into the idea that the universe, in all its aspects, is the outcome of purely deterministic automechanical sequences. It is this type of erroneous thinking which characterizes Bertrand Russell's statement ". . . that man is the product of causes which had no prevision of the end they were achieving and his origin, his growth, his hopes and fears, his loves and his beliefs are but the outcome of accidental collocations of atoms. . . ."

The point may be made that the record of evolution, as we know it for living organisms, appears to be a hit-or-miss affair. There have been numerous types of animals which evolved in such fashion as to insure their own extinction. In other ways, too, there are the marks of what superficially appear to be mechanical or aimless sequences in evolution. However, if the degree of material organization conditions the manifestation of the wisdom of nature, then the intelligence available in the lower orders of design would be in sharp contrast to conscious intelligence. For example, there is a vast difference betwen the organization and associated mind of an amoeba and that of a human being. We ourselves are made up of a hierarchy of designs and corresponding grades of intelligence. The functions of a human body require the precise integration and harmony of countless bil-

lions of structural designs and events for every second of its life. The nature of the intelligence involved in this inconceivably complex operation is as yet a profound mystery.

It appears, according to what we observe in the evolution of living organisms, that a particular design in nature is the precursor to as many secondary designs as possible. Obviously, to become established, a new system of matter and energy must conform with natural laws and conditions. In other words we would expect something equivalent to the idea of natural selection to apply in both inorganic and organic evolution. It is this principle in nature, to do everything that can be done with a particular situation, that gives the appearance of mindless operations. However, as evolution proceeds, it would appear to be necessary to tap the full potential of nature's capacities for each advance in organization, and this necessitates the accumulation of what we might term experience or information. There are far more families of reptiles which have become extinct than have survived to the present, but our modern reptilian forms are more advanced than the earlier types, especially in increased brain development. In this instance, the conservation of information is exhibited in reptilian forms. Every animal form in its early embryological development summarizes past evolutionary stages. So what appears to be the random production of types in organic evolution is in fact a logical approach to the problem of mobilizing the resources of the mind of nature. We utilize the same principle when we practice a set of actions until we can express our capacity for whatever is involved.

The idea that evolution has proceded by the "outcome of accidental collocations of atoms" is based, as mentioned earlier, on the device of beginning with the end product of evolution and tracing the sequence backwards in time. In this way we arrive at the conclusion that with sufficient knowledge we could predict future states of the universe. However, as we have pointed out before, the study of known sequences of designs in nature reveals that a particular organization is incommensurable with the precursor states. This is so at the inorganic level. The example given earlier of oxygen and hydrogen combining to form water testifies to this principle. The development of germ cells into plants and animals proceeds through stages of organization completely at variance with the precursor states. Further, it is well-known that in the development of living forms the adult state emerges from the single cell in such fashion that at every stage the organism is an integral whole, which includes the design or information of what has existed earlier.

The unpredictable element in the successive stages of evolutionary development is to be expected if nature is an expression of mind. If we accept this concept then all the phenomena of the universe, past and present, animate and inanimate, are manifestations of the mind of the universe. Therefore it is logical to assume that such a mind would contain the possibility of myriads of universes in the future. Hence, it is impossible for us to predict what such a mind would evolve from a particular situation. This would be so even if we had the knowledge of all the natural laws which govern phenomena. The idea seems to be prevalent that natural laws and conditions determine what the universe will be, but it is obvious that these are factors which modify a production. For example, in writing a letter we must conform to natural laws and conditions, but this does not decide the content of our communication. An artist in painting a picture is limited by the qualities of the materials he uses, but these are negative influences and do not determine the essential values of his productions.

THE concept we are advancing necessitates the deduction that we, as human beings, are particular reflections of universal intelligence and our minds must function according to the general principles which apply to all nature. Hence, the evolvement of the universe perhaps can be likened to the growth of knowledge or consciousness within ourselves. How does our knowledge evolve? The development of our understanding seems to have much in common with the development of a living form. We are introduced to a new field of knowledge. We begin with what might be termed seed ideas which, in the course of study and thought, expand into an ever increasing comprehension of the subject. As we learn, there is a constant reorientation of our knowledge. At any particular stage our understanding comprises a system or pattern which integrates the fruits of our activity. Our knowledge grows and develops from within analagous to the growth and development of an organism or a universe. Our concepts of the moment lead to new ideas and viewpoints unpredictable on the basis of our previous understanding.

A human being contains the inanimate as well as the animate. Below the level of the cell, another hierarchy of structures and actions proceeds from the highly organized protein molecules down through other organic and inorganic chemical entities to atoms and subatomic states of matter. The atom itself is resolvable into electromagnetic energy and, at this point, matter fades into the apparent homogeneity of space. All and everything is the product of differentiations arising from a common substratum. The concept that mind, as reflected in organization, is the reality in nature, unites all aspects of the universe, as we know it through science, into a consistent whole.

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A COSMOLOGICAL THEORY OF THE SOLAR SYSTEM

Bertrand A. Landry

A Four-Dimensional Approach

THIS is the second in a series of papers investigating the hypothesis that our three-dimensional universe, which appears to extend indefinitely in all directions, is really finite but derives its apparently infinite size from curvature in a four-dimensional space, in the same way that the two-dimensional surface of a sphere owes its lack of a boundary to curvature in the third dimension.

The first paper written by the author[1] showed that, from considerations of symmetry, it was possible to arrive at a complete grouping of the chemical elements provided that the number of possible elements was taken to be exactly 120. It was pointed out that this number corresponds to the number of three-dimensional dodecahedra forming the "surface" of a four-dimensional dodecahedron, thus suggesting a possible relation between the properties of the elements and those of a special kind of Euclidean four-dimensional space, specifically a space whose characteristic lattice is that of its regular polyhedra.

Continuing studies by the author of the physical and chemical properties of the elements and of their compounds in relation to the particular space just described have shown that the relation is a dynamic one, and that it has held since long ago, as it holds now to yield, as one example, the regular structure of crystals.

In this paper, the atomic domain shall be temporarily put aside in favor of the solar system, and the attempt will be made to relate the number of planets and their distance to the sun to the lattice parameters of our four-dimensional space. The premise, of course, is that if our universe is in dynamic relation with such a space at the atomic scale, it may also be at the human scale and at the grand scale of the solar system.

The Primary Data

TABLE 1 lists the known planets and their respective distances from the sun, Earth's distance being taken as 10. In all instances, the distances shown are the length of half of the major axis of the orbit. Table 1 also gives, for historical reasons, the planetary distances as given by Bode's law (discovered by Titius but published by Bode). This law is obtained by writing the sequence.

0, 3, 6, 12, 24, 48, 96, etc.,

and adding 4 to each term. It is seen to agree well up to Uranus but to fail for Neptune and Pluto.

	Half of Major Axis	Bode's Law
Mercury	3.87	4
Venus	7.23	7
Earth	10.00	10
Mars	15.24	16
Asteroids	(27)*	28
Jupiter	52.03	52
Saturn	95.55	100
Uranus	192.18	196
Neptune	301.10	388
Pluto	396	772

* Average distance.

Table 1. Planetary Distances from the Sun

Table 2 presents, for the six regular polyhedra of four-dimensional space, two of the properties of these polyhedra that will be useful. These are the number of 2-D (two-dimensional) surfaces that bound the 3-D (three-dimensional) volumes which in turn bound the four-dimensional figure[2].

	2-D Surfaces	3-D Volumes
C_5 Tetrahedron	10	5
C_8 Cube	24	8
C_{16} Tetrahedron	32	16
C_{24} Octahedron	96	24
C_{120} Dodecahedron	720	120
C_{600} Tetrahedron	1200	600

*Table 2** Geometrical Properties of the Six Regular Polyhedra of Four-Dimensional Space

* The reader must bear in mind that just as an ordinary polyhedron in our familiar space is bounded by two-dimensional surfaces, so a four-dimensional figure in Euclidean space is bounded by three-dimensional volumes. In the table above, the subscript numbers in the column on the left give the number of regular volumetric polyhedra which in each case bound the four-dimensional figure. The type of polyhedron is listed in the second column.

Fundamental Hypotheses

IT will now be assumed that the planets were formed as a result of the condensation of the nebula surrounding our sun in the early stages of its formation, but it will be postulated that condensation took place in two consecutive and independent series of events separted by a long interval of time.

Now, let us say that the fundamental reason why the human ear accepts and likes the eight notes of the diatonic scale and also likes the added five notes to yield the chromatic scale is due to resonance with the postulated lattice of the four-dimensional space with which we are in dynamic relation. In similar fashion we shall assume that C_8 in the above table (the four-dimensional analog of the cube) is in like relation to C_5 in the table, which is the four-dimensional analog of the familiar tetrahedron. Then let us say, similarly, that eight planets were formed during the first period of condensation and five during the first period.

It will be supposed that, during the formation of the first series of eight planets, the nebula extended far beyond Pluto and that eight gravitational troughs developed around the sun at distances (from Table 2) of 10, 24, 32, 96, 2 (96) = 192, 3 (96) = 288, 4 (96) = 384 and 5 (96) = 480 = 4 (120), Earth's distances being 10.* Reference to Table 1 shows that five of these numbers correspond closely to the distances of Earth, Saturn, Uranus, Neptune, and Pluto. To the three remaining postulated planets at distances 24, 32, and 480 will be given the designations X_1, X_2, X_3.

Figure 1 represents the relative sizes of the postulated orbits which for simplicity are shown to be circular instead of elliptical. The three innermost circles represent Earth, X_1, X_2. Figure 2 represents the orbits of Earth, X_1, X_2, and Saturn at a scale which is five times that of Figure. 1.

It is imagined, of course, that after the nebular gases assembled in their orbital troughs, gravitational attraction resulted in the formation of gaseous and eventually liquid and even solid planets, when their size was small enough and their distance from the sun large enough to permit rapid cooling.

At a much later period, when the residual nebular material was within the orbit of Saturn, a similar phenomenon is assumed to have taken place yielding five orbital troughs at distances 5, 8, 16, 24, and 5 + 8 + 16 + 24 = 53. Figure 3 represents these orbits at the same scale as Figure 2. Reference to Table 1 shows that 5, 8, 16, and 53 correspond closely to the distances of Mercury, Venus, Mars, and Jupiter. To distance 24 is assigned Planet X_4.

Discussion

IT will be observed that the solar system now comprises two planets at distances 24 (X_1 and X_4) and another planet nearby at distance 32 (X_2).

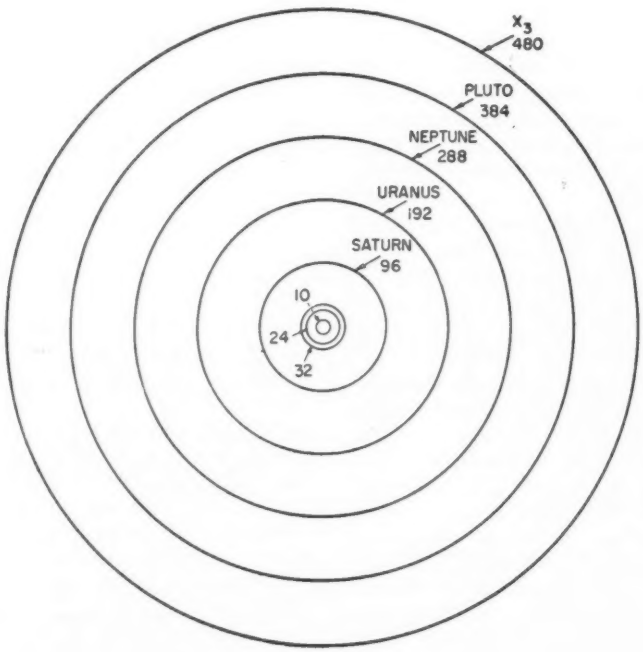

Figure 1. The Postulated Orbits of the Eight Planets Formed Initially

* As we are dealing with eigenvalue problems which are linear and homogeneous, then if f is a solution. kf is also a solution (where k is an integer). Moreover if f_1, f_2, etc., are solutions, for a given system, then $f_1 + f_2 + \ldots$ is also a solution.

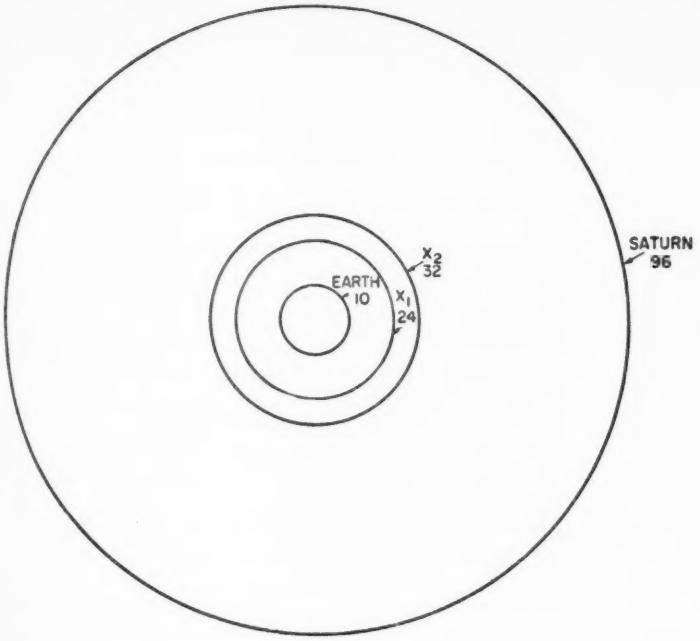

Figure 2. The Central Portion of Figure 1 Enlarged Five Times

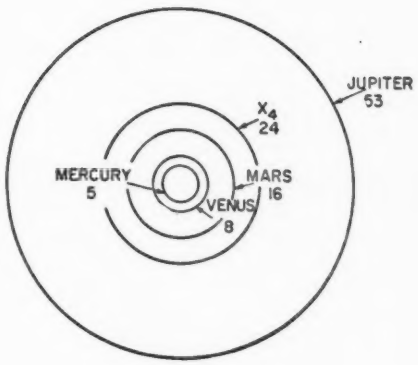

Figure 3. The Postulated Orbits of the Final Five Planets Formed

A collision can be imagined to have happened between these three planets, thus forming the Asteroids at an average distance of $(24 + 24 + 32)/3 = 26.7$ in agreement with Table 1. It is necessary here to suppose that Mars was still in the process of forming when the collision occurred; this agrees with the natural supposition that planets closer to the sun would liquify and solidify later than those farther away because of less rapid cooling.

Planet X_3, at a distance 96 below Pluto, remains to be discovered. Use of Kepler's third law that the square of the period of revolution divided by the cube of the major semi-axis is a constant for all planets leads to an estimate of 330 years for the period of revolution of X_3. Pluto's period is about 250 years.

Planet X_3 would be the oldest planet, followed by Pluto, Neptune, Uranus, Saturn, part of the Asteroids and Earth.. Earth, in turn, would be older than Jupiter, the latter being followed by the remainder of the Asteroids, Mars, Venus, Uranus, and Mercury the youngest of all planets.

Conclusion

APPLICATION of the principle that the properties of matter are determined dynamically by the postulated lattice properties of the four-dimensional space in which our three-dimensional world is considered to be just a thin bubble, leads to a plausible explanation for the relative size of the planetary orbits.

This approach has also the advantage of providing a mechanism for the formation of the Asteroids.

Finally, the prediction is made that a tenth planet should be discoverable beyond Pluto at the relative distance of 480 from the sun, Earth's distance being 10.

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A TEMPLE OF UNDERSTANDING

Juliet Hollister

A Proposed Interfaith Center that will Educate the Peoples of the World in the Meanings of the Great Living Religions

WHO can tell where a story begins, or when the seed of an idea, which perhaps has long lain fallow, first sends out its delicate tendrils into the air? The concept of a Temple of Understanding unfolded from small beginnings, but it has grown with a strength and vigor which seem to have been implicit within it from the start.

The beginnings a year ago were indeed small: just a conversation between two friends (Virginia Prout and myself), which started on a personal level and gradually turned to the problems which are so much in the forefront of everyone's mind and heart—the confusion and violence abroad in the world, the lack of understanding, the rivalries and tensions. Before the spectacle of nations at bay, the individual feels frustrated and helpless. The fact that there are millions of men of good will living in every corner of the globe, who daily long and pray for a world at peace, seems to have no effect upon the brawling course of world affairs. Why should the hopes and aspirations of so many have so little meaning? Could the reason possibly be that there is too little *real* communication among men in spite of all our rapid communication devices—too little understanding of the spiritual values which we all hold in common, too little appreciation of the ways in which different ideas and beliefs unite in shared principles? There seems always to be so much concentration upon how cultures and nations differ; perhaps something more real and tangible could be achieved in international understanding if an opportunity were afforded to educate men in the ways in which they unite. But in what areas would such unity exist? Surely, my friend and I thought, in that essential part of man's nature which we call spiritual. Every religion teaches the same great precepts—the Fatherhood of God, the brotherhood of man. If in practice Moslem and Jew resent one another, if the Christian misinterprets the Hindu pantheon and the Buddhist misunderstands Christian ethics, this surely results from lack of understanding of the core teachings of each of these great religions, not from the teachings themselves.

Having come to an agreement about all this, my friend and I were encouraged, and began to think of how, if we could have our way, we should set about changing this state of affairs. What if there could be one place in the world, we thought, one building, one focus of light, where all men could see how others worship, what they believe, and learn for themselves the wisdom contained in the scriptures and source literature of all the great living religions of the world? What if in such a building, we went on, there should be many wings, each with a small chapel which would faithfully fulfill the rituals of each of these religions, and would welcome visitors from other faiths? What if, between the chapels, each religion should be represented by a library which would include all the books needed to explain the history, the growth, the spread, the ritual, the divisions and denominations, of each of the great religions? And finally, what if, in such a place, scholars versed in each of the religions were available to answer questions and teach visitors the essential meanings and significance for the believer of those customs which, to a non-follower, often seem so strange and inexplicable? The aims and results would surely be educational in the best sense; seminars, lectures, courses and discussion groups would help to make it possible for serious students as well as interested laymen to share the inherited insights of the great world cultures. Would not the very existence of such a center, and the possibility of the millions who might learn from it, help to achieve a degree of world understanding by focussing upon unity rather than separateness, upon universals rather than differences?

We were tremendously excited by this idea, and began at once to plan a building that could give material form to the concept of religious understanding. It should be round, we held, to show the unity of all life. The center should be of glass faceted like a diamond to let in all the sun, symbolic of the light of spiritual knowledge, and this in turn should be caught in a pool, so that within the very heart of the building there would be a quiet focus of light. Even at night, we agreed, this diamond will glow and shine, to show that understanding has a constant light, unaffected by the outer darkness. From this central dome will radiate six wings, like rays from the sun, each the home of one of the great living religions of the world: Hinduism, Islam, Buddhism, Confucianism,

Judaism and Christianity. And within each wing a chapel, perfectly designed in miniature to serve the needs of worship for each religion and to display its form and symbols, and beside it a library and reading room, where the student may discover for himself the teachings of that faith.

Thus in the space of an afternoon, in a dialogue between two friends, the idea of a Temple of Understanding was conceived. Before it could take proper shape, however, there was need for time to pass and for the interest and support and enthusiasm of others to become aroused. My friend and I were without the influence or the prestige necessary to launch such a concept. We were fortunate, however, or perhaps the idea which had come to us was one which others welcomed because they too had been searching for something like it. In any case, I was able to enlist the active help of another friend, Lathrop Douglass, who at once grasped the significance of the idea and swiftly produced the beautiful design of the Temple of Understanding which is illustrated. Armed with this, I approached Mrs. Eleanor Roosevelt and won her assent and generous help. It was she who suggested a trip around the world, in order to awaken the interest and enlist the support of religious leaders and heads of states. Mrs. Roosevelt wisely felt that only in this way could the project become truly international, involving Hindus in India and Buddhists in Japan in active cooperation with Christians in the United States, Moslems in the Middle East and Jews in Israel. Let the peoples of the world create this building, she said, and then it will belong to the whole world: It will be a spiritual United Nations.

THIS was the real beginning of our venture. I took Mrs. Roosevelt's good advice; I visited our Embassy to the United Nations and talked also with many other United Nations representatives. I went to Washington, and spent many hours in the State Department, in Senator Fullbright's office, the USIA, the Voice of America, and elsewhere. Everywhere there was warm and friendly interest, and more—a growing identification with the plan on the part of so many that I became more and more convinced that we were really giving shape to the unvoiced, unrealized dream of many, many people. The Temple of Understanding, which we were beginning to feel should be erected in Washington, was growing in reality.

So I left the United States with my young son as companion, and traveled around the world as Mrs. Roosevelt and others had said I should, visiting Rome, Cairo, New Delhi, Bangkok, Hongkong, Tokyo and Honolulu. Everywhere we met friendliness and surprising support. Moslems and Hindus, Buddhists of Southeast Asia and of Japan, Chinese scholars in Hongkong — all promised to help. Everywhere, too, we found one general reaction, which became almost a stereotype. The first response seemed always to be surprise that an American should come on such a mission. The people of the Eastern world said again and again that they had not believed that there was any general interest in spiritual things in the United States, and certainly none in the religious beliefs of other peoples. Their experience of Americans abroad had led them to believe that we were only concerned with material prosperity, with technological advance, and with winning the cold war. We did our best to explain that American democracy is founded upon religious principles, and upon the explicitly stated freedom of every man to worship as he chooses, and that the Founding Fathers wrote into our Constitution their conviction that the lawful orders of society are rooted in a universal spiritual order. We told them that we felt that the dream of freedom which is so much a part of the American heritage could be fulfilled in no better way than to build in its capital city a center erected to understanding, where people of every faith, every race, every color could freely learn to appreciate and respect the insights of other cultures. In such a building, at such a place, we said, we hope to show to people of other faiths the true face of the Christian tradition in America.

BACK home, encouraged by so many cordial assurances of support from abroad, we met with some discouragement—perhaps to convince us that human beings still have to overcome obstacles of personal limitation. Some thought that the building should not be round, and that the wing which housed the Christian faith should take precedence over the rest. To this, of course, we could not agree, for it would destroy the very purpose and concept of the building. Again, it was felt by some that our inscription, "Truth is a diamond of many facets," should not be used, although it is intended to imply that no human being can, in honesty and in humility, claim to know *all* the truth. These difficulties were discouraging, as was the statement by one philanthropist that we should never be able to bring the Christian and non-Christian worlds together. Yet, just as the plan seemed on the verge of collapse, our movement gained new strength. We had already a long list of sponsors, among them religious and political leaders all over the world. Now we began to receive the support of Christian ministers of all denominations—Episcopal, Congregational, Methodist, Lutheran, Baptist, Presbyterian, Unitarian, Universalist—as well as the sponsorship of many Jewish Rabbis. With this impetus our group of sponsors began to grow by leaps and bounds. There is now a Board of prominent religious leaders; Rabbi Goldstein, Dr. Radhakrishnan, Bishop Hanayama, Dr. Wen Yen Tsao and Dr. Martha Jaeger, who have joined with businessmen and others to assume direction of the project. Together, now that the idea has grown into a plan

and the cooperation of spiritual and political leaders has been won, this Board is embarked upon the realization of the necessary funds to create and endow the building. As the originators of the project feel that the means of creating this building are as important as the completed project, it is our desire to initiate a world-wide campaign for funds. By this method, it is hoped first, that the interest and support of world citizens at large, regardless of age or position, may be captured, second, that all the peoples of the world who wish to reinforce the idea of world understanding may have an opportunity to do so, and finally, that the building which results shall have spiritual significance rather than merely material prominence and splendor. It is hoped that one day, when these "contributors of the world," who have given their dollar or its equivalent, come to visit our nation's capital, they may show their children their names engraved on the structure of this symbolic edifice and say, with some pride, "I, myself, helped in the creation of this Temple of Understanding!"

Our need is, now the ever-increasing support and encouragement of men and women and children of all faiths, who are in sympathy with our aim to erect a Temple which will not be a house of worship but rather an *educational* enterprise with a threefold purpose:

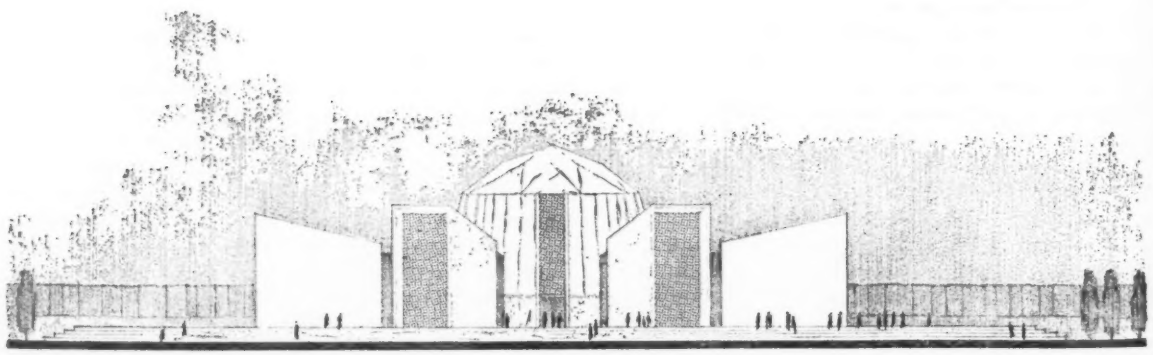
First—That this Temple of Understanding will stand in the eyes of the world as a symbol of the brotherhood of mankind, and of our awareness and acceptance of this fact;

Second—That, by having in one place the accoutrements of the living world religions, the basic texts to explain their beliefs and aims, as well as a proponent of each religion to explain the concepts behind the symbols used and the historical significance of the faith, all people, and especially the new generation, will become more cognizant of the rich and varied spiritual life of their fellowmen. This, in turn, should establish more profound political, social and spiritual relationships, and so help to build a more stable and peaceful world.

Third—That this "place of understanding" will prove to be far more than a mere building. It is hoped that it will render an inestimable service by stressing the spiritual values in human life. The end result of material abundance, we have learned, is not necessarily either personal happiness or peaceful co-existence. To emphasize the spiritual aspect of man's humanity—leading to greater enlightenment and a more profound concept of happiness—will be an essential function of this Temple. As we are rapidly entering into a new era of global relationships, and the boundaries of both time and space are shrinking in dimension, it is felt that universal understanding must inevitably replace nationalistic limitations, and that such an understanding of our neighbors' religious aspirations must, of necessity, be common knowledge for the citizen of the world.

Thus a dream advances toward realization. Like every other image of man's hope and aspiration, it must be shared; many have to breathe upon it to give it life. If you who read feel a response to this need, we hope you will write to us.

Maher Avenue
Greenwich, Conn.



The Temple of Understanding

Lathrop Douglas F.A.I.A., Architect

The Command Power of Magnetic Fields

NEARLY 100 years ago, James Clerk Maxwell produced a set of partial differential equations which were destined to revolutionize, not merely the field of physics, but man's entire understanding of the universe, and the laws of its operation. Maxwell's immediate concern was the Electromagnetic Theory of Light, but the consequences of his insight were felt throughout the entire field of theoretical physics. Field physics, which includes such areas of investigation as the gravitational field and the electromagnetic field, is a development of Maxwell's basic concepts. Modern chemistry — both atomic and nuclear — owes a debt to Maxwell, and the list of consequences has not yet reached its end.

Within the past decade a new field of physics has attained much importance in the thinking of theoretical physicists. This field is *plasma physics,* which deals with the motion of ionized media such as gases in the presence of external forces, generally magnetic fields. It may seem surprising that plasma physics was not initiated earlier, since it involves only ideas and laws known to Maxwell a century ago. However, it was not until man began to dream of harnessing the stupendous energies available in nuclear fusion processes that any practical applications of plasma physics, upon a terrestrial scale, became conceivable. Heretofore, plasma physics was of concern only to astrophysicists, in the study of such cosmic phenomena as solar flares, or the movements of the highly-attenuated "matter" encountered in the reaches of inter-galactic space.

The December 1960 issue of *American Scientist* (Vol. 48, #4) contains a fine article, "Plasma Physics," by Russell M. Kulsrud of the James Forrestal Research Center at Princeton University. Dr. Kulsrud's project is controlled nuclear fusion, and his specialty is concerned with the problems of equilibria and stability in plasma physics. In his article, Dr. Kulsrud links aspects of these man-initiated enterprises with parallel phenomena in the astrophysical realm. Space limitations restrict us to the inclusion of only a few of the more pertinent observations by the author.

"The first main impetus to this field has come from astrophysics," Dr. Kulsrud states, "and many current applications might have been suggested by astrophysics. One of the features of a plasma is its ability to be controlled by magnetic fields alone without the need of material walls. The tendency of a conducting gas to follow invisible magnetic lines of force is shown very beautifully in pictures of solar prominences, where the emitting matter is seen to follow long arcs above the solar surface. These arcs can only be the lines of force of a strong magnetic field. Other important effects of the magnetic field on a plasma may also be observed in the sun. It has been known for fifty years that the dark areas of the sun's surface, known as sunspots, have large magnetic fields of several thousand gauss associated with them. These sunspots are the cooler regions of the sun's surface and it is suspected that the cooling is accomplished by the action of the magnetic fields, although as yet no adequate theory has been developed to explain in what manner the cooling takes place.

"A more dynamic example of the action of the solar magnetic field is the solar flares. These are hot spots which arise on the solar surface and last for only a short time. . . . Perhaps a rapid increase of the magnetic field with an accompanying induced electric field accelerates particles and heats the solar gas. Associated with these flares is the production of a large number of high energy particles and many cosmic rays, which perhaps are due to some effect in the flare similar to betatron action."

One of the earliest possible applications of our knowledge of plasma physics concerns the possibility of controlled nuclear fusion. When perfected, this would provide an almost-limitless source of available energy, and wipe out forever the spectre of our rapidly-dwindling mineral resources (coal, petroleum) which play so large a part in the current picture of our energy reserves.

To attain nuclear fusion of, for instance, deuterium gas, the gas must first be brought to a temperature of several hundred million degrees, and must be maintained at that temperature while a sufficient number of nuclear reactions take place. Since *material* walls cannot exist at this temperature, and since walls at lower temperature would cool the gas below the nuclear reaction level, the use of material walls is out of the question. Magnetic fields, however, might "contain" the deuterium plasma, much as the motions of prominences above the sun are constrained by magnetic fields. And the plasma can be thus contained as long as the field can be maintained. It might be expected, therefore, that a hot gas could be held together long enough, without cooling, that a sufficient number of fusion reactions occur to make a practical fusion reactor. This description is, admittedly, an over-simplification; and a number of practical problems must first be overcome before such a reactor becomes a reality.

Dr. Kulsrud mentions many other possible applications of plasma physics, when once the subject is better understood. Among these is the use of an ionized gas plasma as ejection material for rocket propulsion of interplanetary spaceships. Using

chemical rockets, we are limited to the comparatively low velocity at which the chemical fuel is ejected. The final victory of a rocket cannot be greater than this ejection velocity. But by using as fuel a plasma of ionized gas, the rocket could be accelerated hydromagnetically to extremely high velocities; and this acceleration process is not unlike that which occurs in a solar flare.

We do not normally think of the earth as orbiting "within the sun's atmosphere," yet from the standpoint of plasma physics this may well be the case. We know now that swarms of material particles are controlled by the hydromagnetic field of the sun at distances far greater than the radius of earth's orbit. Speaking of these phenomena, Dr. Kulsrud has this to say:

"Occasionally, some matter ejected from the sun's surface can escape from the sun's magnetic field . . . and this matter continues outward. It may strike the earth, producing hydromagnetic phenomena of various kinds. It will penetrate the earth's field, pushing it aside. This change in the field of the earth leads to magnetic storms. It also enables the newly-arrived matter, or matter already present in the region surrounding the earth, to strike the earth's surface near the magnetic poles, producing aurora. The matter actually trapped in the earth's magnetic field many earth radii out is replenished and diminished by these streams, and the presence of such layers of charged particles, such as the Van Allen belts, are undoubtedly due to these streams of matter from the sun's surface. Thus, in many ways, *the earth and its surroundings are in intimate hydromagnetic contact with the sun.*" (emphasis added)

As one goes to bigger dimensions, on the order of the size of large interstellar dust clouds or even of the galaxy, the magnetic field is seen to play a dominating role in both structure and evolution. The magnetic field seems to be in equilibrium with the kinetic energy of motion of the interstellar clouds of matter. Furthermore, the energy density of cosmic rays is approximately the same as that of the magnetic field. Fermi has suggested a mechanism whereby changing interstellar magnetic fields can accelerate cosmic rays up to the enormous observed energies. Young, hot stars will continue to be born as long as there is unburnt hydrogen around to form them; their intense radiation accelerates a neighboring interstellar cloud; the cloud compresses and distorts the interstellar magnetic field; and it is this which accelerates the cosmic rays. Arising from such a reaction, cosmic rays may be said to be truly cosmic.

This interstellar magnetic field is undoubtedly associated with the formation of galactic arms since it performs a large role in the motion of interstellar dust and gas. In fact, the arms are very similar to magnetic lines of force twisted by galactic rotations.

"Where did the interstellar magnetic field come from?" queries the author. "There are no currents around which could be said to be responsible for its origin. The answer seems to be it is primeval. It has existed as long as the rest of the universe and was created when dust and gas were. In other words, the problem of the origin is removed for the time being, until we know more of the origin of the universe."

In the original article, in *American Scientist*, Dr. Kulsrud discusses, in considerable detail, the properties of a plasma, and considerations involved in the production of a fusion reactior—both of which are beyond the scope of this abstract.

—Alan Mannion

Existential Psychology—a New Force

THERE have long been established in American psychology two main systems: behaviorism and psychoanalysis. In 1958, however, Maslow and Sutich wrote an unpublished paper about Ortho-Psychology in which they described the emergence of what they called a Third Force in psychology, comprised of those who are interested in the human capacities and potentialities that have no systematic place either in positivistic or behavioristic theory or in classical psychoanalytic theory. This group of psychologists is primarily interested in potentialities such as creativeness, love, self-actualization, values, ego-transcendence, objectivity, responsibility, psychological health, and so on. And although they grant that the point of view of this "Third Force" in psychology has not yet been synthesized, and that it is not yet as comprehensive as the Freudian or behavioristic systems, they feel this will soon come to pass.

Prompted by a reading of the paper by Maslow and Sutich, Adrian van Kaam of the Department of Psychology, Duquesne University, delivered a lecture entitled "The Third Force in European Psychology—Its Expression in a Theory of Psychotherapy." This has recently been published by the Psychosynthesis Research Foundation, Greenville, Delaware, as a contribution towards the synthesis of American and European psychological thought. The complete text may be obtained from the Foundation.

Dr. van Kaam was particularly struck by the fact that the objectives which Maslow and Sutich describe are to such a large degree the same as those which took place under the influence of the so-called phenomenological-existential movement. His lecture was based upon his realization that at that time (1958) important groups of psychologists in the United States and in Europe who cherished the same ideas were unable to profit from each other's theories and research. Van Kaam offers several reasons for this. One is that current American journals present such a one-sided picture of American psychology as to leave many European psychologists without hope of a sympa-

thetic hearing in America. Another obstacle to mutual understanding is the fact that Third Force psychologists in Europe were inspired by modern thinkers in philosophy, from whom they have borrowed not only concepts, methods and theories but also terms and expressions which are strange to many psychologists. Finally, psychological provincialism is of such long standing that various psychologists of both continents speak a different language even when they try to express the same ideas. Thus the growth of a synthesis is hampered by lack of mutual understanding.

As Van Kaam points out, phenomenological-existential psychology is not a school like original behaviorism, association psychology or psychoanalysis; it is rather an attitude pervading the whole of psychology, renewing and reshaping it. It is, in fact, difficult to find a European psychologist who is completely untouched by the new trend. Every psychology is necessarily based on certain prescientific assumptions. One of the deficiencies of other systems of psychology was that the scientists concerned did not reflect on their assumptions. This new trend discusses its assumptions very frankly, but to evaluate them requires understanding of the background. Further, without some historical knowledge of the movement, it is difficult to grasp the relation of the new trend to philosophy, culture and other schools of psychology.

Since it is impossible to cover all this ground in a single lecture, van Kaam confines himself to a discussion of the basic tenets that the various existentialists have in common, and an illustration of this way of thinking through its possible application in the field of psychotherapy.

When the term "existential" is used in connection with psychology, it is not primarily or exclusively related to one or the other philosophy which calls itself existential. Van Kaam writes: "Those philosophies are for us important incidental symptoms—some balanced, others unbalanced —of a far more important change in the Western culture. Our use of the terms 'evistentialism' and 'existential' intends primarily to label this shift in the Western Culture, this transition from an isolated individualism, one-sided rationalism and positivism and blind collectivism towards a growing concern for real human community, for human commitment, and authentic values. This matrix of a new cultural period into which we are rapidly moving finds—like every cultural period—its articulation in philosophy, literature and science. But every individual expression of the 'lived' development of a human culture is necessarily limited by its individuality. . . . At present it is realized that the core of the new cultural trend is the idea of existence or, what may be considered synonymous with it, the idea of intentionality. This core could be briefly formulated as the conviction that it is impossible to think of subject and world as separate from each other."

The intent of phenomenology is to describe human experience. This description is based on certain methods, but not those of classical introspection, which tried to describe the experience of the isolated human individual. The phenomenological philosophers try to discover through an intuitive approach the very essence of things; the phenomenological psychologist aims at the description of the human individual in a situation, using the same intuitive method as the philosophers, but applying it to his own area of interest.

Existentialism is a natural outgrowth of phenomenology. Again not a school nor even a group of thinkers, it is a collective name for widely divergent currents of thought which have a few characteristics in common. Of these, perhaps the most important is a deep concern with concrete human existence. Existentialists ask these questions: what is the meaning of existence for man; what is the aim of life; is a person free to shape his own existence; has man responsibilities? Existentialism studies human life not as an abstract quantity but "here and at the moment in its lively quality." Under the term "existence," the human being is seen not only as a conscious being but a conscious being that is in the world. Existence infers a standing outside of oneself, a going beyond oneself; the human being is "there" — present there in the world. This conception of man as a consciousness that is world-bound, that is always found in an environmental world made meaningful by this consciousness, is fundamental in existentialism. Thus it takes its stand against rationalism, which considered man as "pure consciousness," and also against empiricism and positivism, which made man totally a part of the world, subjected to the laws of a postulated material universe. Instead, existentialism confirms the basic intuitive conviction of mankind that man has his own characteristic place in the universe. In shaping his world by making it meaningful in relative freedom he is not complete subjected to physiological or physical laws.

Another important point brought out by Van Kaam is that existentialism sees human existence not as static but as in continual development, which in turn is world-bound, since all that is in man—knowledge, emotions, intuition, and volition —develop in contact with the world. Existence is thus essentially becoming. Nor is it perfectly determined by compelling laws as others things in nature; human existence is at least partly conscious and free, for we "become" in freedom.

Since the basis of this philosophy lies in the conscious experience, the psychologist starts his thinking by retiring into this existential sphere of experience. The philosopher conceptualizes his experience, but this conceptual knowledge has to be based totally on true and authentic experience. To the existentialist, conceptual knowledge has no independent value; all concepts have to be "existentially loaded."

One of the causes of the impact of existentialism on psychology is undoubtedly the fact that existentialist philosophers devoted themselves to the study of characteristically human phenomena and approached them in surprisingly new fashion. An example is the psychological phenomenon of anxiety as studied so profoundly by Martin Heidegger. The existentialist does not attack anxiety in an empirical inductive way nor try to state statistically when or where it manifests. For him, anxiety is so identified with human existence that he has no hope that he will ever understand it by enumerating the conditions of its manifestations. Instead, it characterizes man just as much as thought, laughter, weeping, language and art; it is not fortuitous or accidental, but an authentic human mode of existence. There is no wonder that this fascinating "new voice about human existence" meant a real revolution in the universities and departments of psychology. The stunning rediscovery that there were other fruitful ways of understanding man besides the positivistic one was a tremendous shock for the European mind which was so deeply committed to positivism. The result was an outburst of psychological and psychiatric publications on the basis of this new view of man, almost limitless since 1926.

Dr. Van Kaam devotes the remainder of his paper to a discussion of existence and therapy, with particular reference to guided day-dream technique as an illustration of existential psychotherapy. He also includes numerous references and an extensive appendix of English literature on existential psychology and psychiatry. To this should be added the new-founded *Journal of Existential Psychology,* details of which are to be found on page 70, and the forthcoming *Journal of Humanistic Psychology,* sponsored by Brandeis University, edited by Anthony Sutich, and with a Board of Directors which includes Erich Fromm, Kurt Goldstein, Abraham Maslow, Rollo May, Clark Moustakas, Lewis Mumford, and others. These two new journals should contribute a good deal toward the growth and strength of the Third Force in American psychology.

—E. B. Sellon

NEWS AND NOTES

MOST of the countries of the world, whether old or new, are today confronting a stubborn domestic problem. This problem, which is basically educational, has been evident for at least the last ten years in the United States, where the public, secular school system is perhaps the most important single factor in a democratic structure of representative government.

The nature of the problem is this; Tax-supported schools, like those in America, are being set up in many different lands, with different cultural backgrounds. But it is widely recognized that education without a consensus as to meaningful value goals cannot offer sufficient and reliable guidance for children. This is partly because goals which remain aspirational ideals, unintegrated with and unsupported by the best of human knowledge, lack force and conviction; they do not furnish a program for life. Often such ideals are sustained as tradition and doctrine based in religion, so that theology functions as an *ad hoc* philosophy. In church-related schools this heritage can be employed, but public, secular schools constitute a break with this tradition. In them, therefore, true education cannot fully function without at least a tacit, working agreement as to the nature of man, his as yet undeveloped potential, and the presumptive purpose of his existence. When education attempts to sidestep or ignore the fundamental relationship of such knowledge to the whole of the educative process, then social disintegration begins.

Therefore the question before our own government, and those responsible for secular public schools everywhere, is: where, how and by whom is a valid philosophy of nature and of man to be formulated and documented, so that it can measure as a criterion good in secular school and college systems anywhere in the world?

The proposed program for a solution to this problem, which has been undertaken by a group of scholars, scientists and lay people in the United States, is prompted by relatively recent developments in exact science which are known to be of profound philosophical and metaphysical significance. It is felt that if the start toward a consensus of knowledge be made within science, and if continuance be insured through sustained research, then the preparation and constant improvement of new teaching materials will afford a course of study which will at no stage violate scientific standards.

One of the most important aspects of this work is concerned with a fundamental question: How do human beings know? The significance of this question for every area of human concern is emphasized by Prof. Heisenberg's discussion of Wolfgang Pauli's interest in the process of knowledge itself. The question reaches into all major branches of contemporary science, from physics to psychology; therefore they must all be drawn upon to yield what they can that bears upon the problem. If this is done successfully, the dangers of producing just another course of study in merely speculative or verbal epistemology will be avoided. Instead, the participant in the study, whether he be professor or pupil, will experience in each instance what it is that it is intended he shall undersand. Then he will not only move on to the understanding, but will in each instance grasp precisely how it is that he does actually know. Such a program can arrive at a consensus through the study of a subject as concrete as (say) that of chemistry, because the aim is not only knowledge or technical skill in the subject under consideration, but an understanding of the self through an exploration of the ways in which learning occurs. For to know how we know is to have an important kind of understanding of ourselves.

From such a firm base, excursions into the arts, history, religion, or any other domain in the humanities become feasible without loss of focus; such enlargements will indeed be inevitable and profitable. The experiential aspect, so important, should always be kept forward; motion pictures, recordings and other aids will permit the systematic treatment of whole bodies of knowledge, such as are necessarily required to convey not only the factual elements, but the valid *conceptual* content.

The group which has operated under the Harkness Grant to the Foundation for Integrated Education has made a firm beginning on the production of basic materials for such a program. This group, which includes F. S. C. Northrop, Henry Margenau, D. H. Andrews, Alfred Taylor, the undersigned, and others, will continue to function in 1961, by which time it is hoped that the research for the proposed program will be well advanced. It is also hoped that the present visit to India in which the writer is engaged will result in the active participation of qualified workers and scholars who can contribute the unique insights of India to what might be called an authentic ideology. Freely arrived at and based on true knowledge, it would be suited to a free, settled and peaceful world society.

It is important to remark that recent developments in the deductive-exact sciences make possible their philosophical reintegration with the essential heritage of all cultures. This is especially noteworthy as regards the heritage which is so richly displayed in continental and greater India. For example, contemporary science as seen in physics, and the *drāvyas* which give distinction to Hindu realism (the Nyaya Vaishesika *darsanas*) are today in close consonance. This state of affairs can be articulated. Therefore, in India it becomes reasonable to inquire whether the other darsanas are equally acute anticipations in respect to the life sciences and to man. Have they been so far substantiated in such limited degree by modern theory in biology, psychology and anthropology mainly because of the failure to establish in those sciences fundamental principles comparable in authority and penetration to those now known about matter and energy in physics? Comparable references, of course, may and should be made to the insights of Pythagoras, Parmenides, Democritus, Heraclitus, Plato, Ammonius Saccas, Plotinus, and others. Arising from these issues, some precise suggestions will be ventured for relevant scientific research in the domain of life and functional form, and man and his works.

The hope of enlisting active support in India for such a reintegrative program is strengthened by the very title of the governmental unit of the Union of India through which we are now working (via the Indian Council for Cultural Relations). It is styled the Ministry of Scientific Research and Cultural Affairs, and the present Minister, Dr. Humayan Kabir, is one of the most distinguished of Indian scolars. The conferences arranged for us jointly by the Indian Council for Cultural Relations and the India International Center are of course scientific, philosophical and cultural in character, but it is important to note that in India such concerns have direct application to governmental and political policy. This is evidenced by Prime Minister Nehru's own works, for in a general public discourse in Bangalore last September he spoke feelingly of "a synthesis of science and spirituality." By this he surely had in mind more than a frail and factitious mixture of realism and idealism, worked up in the name of expediency. India has it in her power to institute a basic reinvestigation, in both inherited and contemporary terms, which could lead to an understanding of the nature of man as knower related monistically to the known. For man, the creator of technologies, is the same man who seeks the good life; he is discoverable in his integral wholeness in the Indian darsanas and in the traditional Indian ways of life which are now adapting themselves to the onrush of scientific advance.

AN article in this issue of MAIN CURRENTS initiates along novel lines an inquiry into the origins of the solar system. Previously (Vol. 16, No. 4) the author, himself a chemist, applied the same concept to a re-ordering of the periodic table of the chemical elements. It may be helpful to identify here the background of these seemingly daring proposals. Since brevity is necessary, readers

who have access to Vol. 8, No. 1 are referred to that issue for a broader sketch.

Minkowski pointed out that Einstein's special theory of relativity, by assuming that the velocity of light is constant and the highest possible in physical nature, was in effect saying that a second of time is about 186,000 miles in space, and that therefore (according to Minkowski) time must cease to have its former independence, in physics. Hence there arose the notion of a four-dimensional space-time system. However, few have considered that there is a real domain in nature of this multi-dimensional character. Our sensate habits and the dominance of physicalism and operationalism in science prevent most of us from entertaining any such concept; therefore space-time, and the later n-space of atomic physics, remain ingenious devices to enable science to understand the physical world better, but are not seriously entertained as evidence of anything more than we can sense. It is truly amazing that we can, because we must, admit the existence of non-material force fields, quite supersensory in character, and even latterly of metric fields, and yet remain inert to the possibility that space-time may be a real domain in nature. No doubt part of the problem lies in the fact that the space-time of relativity is in the mathematical sense only quasi-real. In India (where this note is being written), the tradition has never given time the status of an ultimate. *Kāla,* in the Hindu realism, is not time, but is that *drāvya* (ultimate) which gives rise to motion, which we humans mistakenly generalize as time past and time to come, but not here and now. Anyhow, in the Indian tradition time is circular, not linear.

The author of the article here being discussed, Dr. Landry, is not only taking space-time to be a metric field whose properties govern all observable physical phenomena involving motion, but he is ascribing *complete* reality to it, in the mathematician's sense. Such a four-dimensional domain is readily calculated and H. S. M. Coxeter in his classical work, *The Regular Polytopes,* has reviewed and enriched the whole body of knowledge of this complex. In that domain, basic entities are bounded by volumes, just as in familiar three-dimensional space a volume is bounded by a surface. The question arises, then, what is contained? If we concede that the domain in question is space-time, then what is contained is duration, i.e., natural units or creatures which have definable natural lengths of existence. The life of a tree, thus, would be a duration; so also the life of a solar system or the life of an atom.

Dr. Landry thus is merely applying the properties of one of the fundamental polyhedroids of Euclidean space-time to the observable (and predictable) features of the solar system. Bode, by induction, arrived at a fair approximation to a mathematical rule for the planetary orbits. Miller subsequently refined this. Gregory, in *The O-Structure,* incorporated the formula. But the real pioneers in this area are not those men, not even Kepler. For Dr. Landry is employing the specific properties of the four-dimensional analog of the regular convex dodecahedron. He aims to show that the properties of this figure govern the taxonomic symmetry of the periodic table, and also the dynamic symmetry of the solar system.

He is, of course, proceeding with such rigor as our limited space will allow him to marshall. As in the case of the former article on the chemical elements, he is quite ready to expand and to defend the theses he advances given opportunity. All the same his progenitor, in Western culture, is no modern but rather Plato, who bluntly declares in the celebrated passage in the *Republic* that we are chained down to look at the dark wall of a cave, where we take the shadows to be real. It is in the *Timaeus,* I believe, that he assigns the dodecahedron to the role of being the "world figure." Unfortunately Plato was only a genius; he never acquired the status of a Ph.D. Therefore a reference to him adds little or nothing to the cogency of the specific argument in Dr. Landry's article. All the same, it is in order, for it reminds us that daring and imagination are indispensible for the advancement of science. The pedestrians are very necessary, as foot soldiers, to consolidate positions won by talented individuals. Our author is not asking to be believed. He is only asking us to interrogate nature, taking Einstein and Minkowski quite seriously, in *all* the implications, not just a few. What is more, if there are those who, for lack of knowledge of astronomy, chemistry or geometry, are unable to interrogate nature directly themselves, they may address themselves to the author, in our care, if they are prompted to do so.

—F. L. Kunz

The *Journal of Existential Psychiatry,* designed as a professional vehicle for the exploration and study of man as an existential being, has been issued quarterly since May 1960. Under the direction of Jordan M. Scher, M.D., and an Editorial Board which comprises leading doctors and psychiatrists in the United States, Canada, Europe and South America, the *Journal* is designed to provide a medium of communication among those interested in phenomenology, psychology, psychiatry, and related areas. The purpose will be to present man as more than a mere mechanism or statistical abstraction, confined within theoretical frameworks. The fact that the human organism is relatively open to new experience and evinces at every moment the plasticity of a growing, creative agent should be of significance in attempting to understand the individual patient.

It is toward such an understanding that the *Journal of Existential Psychology* is directed.

REVIEWS

Between the Rational and the Religious

Science Ponders Religion, edited by Harlow Shapley (Appleton-Century-Crofts, N. Y., 1960. viii + 308 pp., no index, $5.00), is the first substantial volume to emerge from the Institute of Religion in an Age of Science, which has been holding discussions at Star Island, Portsmouth, N. H., over the past seven or eight summers. The contributors are all eminent American scientists, who have stepped out of character sufficiently to be willing to commit themselves on paper in a discussion of religion. Those interested in the growing pains of scientists as they grope their way toward religion could do no better than to read the brilliant essays comprising this volume.

The basic motive for these discussions is made clear in the opening essay by the editor. It is that of seeking ways of insuring the survival of mankind in light of the frightening destructive power of the atom. Without the ethical restraints traditionally associated with religion it is clear that we will not be able to "restrain indefinitely the genocidal, suicidal madness of man's worst enemy — man himself." Is enough time left to us?

The starting point of all of these essays is that of science, for here is where these gentlemen feel at home. This may explain why some of their conclusions, when they arrive at the religious sphere, sound appropriately more tentative. Doubtless some theologians might term them a trifle unsophisticated, for many scientists do not seem to be able to transcend reason. Their religion has a tendency merely to be Science dressed up in a new suit of clothes. But this is not the significance of the book so much as it is the fact that it shows the scientists troubled and willing publicly to expose their ignorance (if that is what we have) in things religious. It is such unrest and such willingness to risk reputations that constitutes the first step in growth. Would that the theologians were equally venturesome!

Each essay moves between two poles, the rational and what I would call the authentically religious; that is, a sense of the transcendent whether this is to be symbolized by the word "God" or not. The scientist is apt to come closest to such an experience when he contemplates the all but infinitely complex and wonderful aspect of nature that constitutes his specialty. Naturally he looks on that portion that lies beyond his ken as different in complexity but not in kind. Eventually he hopes to apprehend it all by the cognitive processes of his mind. Yet it is doubtful that the sense of awe and splendor that comes over him as he scans the heavens or contemplates the wonder of the atom owes much to the cognitive. It is nearer the experience of the artist, the poet, and the mystic, scornfully though most of these scientists might spurn kinship with the last-named.

Among those essays that emphasize the rational, Hudson Hoagland's is a clear and cogent statement of the position of the scientific agnostic. Henry Margenau and Ian Barbour most clearly distinguish between the functions and methods of science and religion. Theodosius Dobzhansky, the geneticist, seems to me most likely to understand the intuitive approach to religion and the experience of the mystic. More than the average perception of religious values in other ways appears in the essays of Kirtley Mather, Ralph Burhoe, Edwin Kemble, and John Fischer.

But what Harlow Shapley is calling for involves more than an artistic delight in the wonder of nature. It involves the transformation of man himself. It is the psychotherapist as well as the sensitive and experienced pastor who recognizes how much of the psyche of man dwells in the unconscious below the level of cognitive control. There live the savage hatreds as well as the seeds of the creative possibilities of man. It is not therefore intelligence alone that can save us — though intelligence must have its place. Any intelligent man can see that the world is rushing toward disaster, but the modern intellectuals are just as powerless to stop the rush as were the intellectuals that foresaw the French or Russian revolutions. It is men's *wills* that need to be changed if we are to be saved from disaster. This transformation of man does not happen often, but we do know that it *can* happen through (1) psychotherapy and (2) religion. Consequently it is not surprising that religion in this sense seems best understood by a psychotherapist, Henry A. Murray. Despite the fact that Murray styles himself a humanist and that he has little use for the church and the puritanical, dogmatic expressions of Christianity, nevertheless he knows that any religion worthy of the name must have primacy over science, and that "the focus of religious concern is the transformation, the conversion, of the personality at its very center." Nothing less than this will save the world at this desperate pass in history.

—Walter Houston Clark

Dr. Clark is Dean and Professor of Psychology, Hartford School of Religious Education, and author of *The Psychology of Religion.*

The Unchanging Concept of Change

WHEN, in 1950, the Bollengen Foundation issued the Wilhelm-Baynes translation of the *I Ching,* English-speaking people at last had accessible to them the principal classic of Chinese culture, a book which has had for over three thousand years the most profound influence upon Chinese thought, and in which both Taoism and Confucianism have their roots. Beginning almost at the dawn of history, the *I Ching,* or Book of Changes, has furnished a constant spring of wisdom and morality to the Chinese people, and every mode of Chinese thought — metaphysical, scientific, ethical, political and social — has drawn inspiration from it. It has permeated every epoch and every level of society; the pronouncements of statesmen as well as the claims of shopkeepers equally recall its

aphorisms. In his introduction to the Wilhelm translation, C. G. Jung directs attention also to the psychological phenomenology of the *I Ching*, and testifies to its freshness and validity today. It remains to be seen how enduring its influence will remain under communist dominance, but it has in the past survived many adversities and re-emerged with renewed vigor.

Important as it is, the *I Ching* presents problems to the Western student. Therefore, a new commentary by Hellmut Wilhelm, son of Richard Wilhelm who carries on his father's tradition of scholarship, is very welcome. This commentary, which takes the form of eight lectures, has been rendered into English by Cary F. Baynes, and is published under the title *Change* (Bollengen Series LXII, Pantheon, N. Y., 1960, 111 pp., index, $3.00).

In *Change*, Mr. Wilhelm adds considerably to our knowledge of the historical background of the *I Ching*, of the Chinese concept of change and of cosmic order, of the polarity of the two fundamental principles of heaven and earth, and of the meanings in the trigrams and the hexagrams. Perhaps most important, the book is throughout embued with the essential world view which is the foundation of Chinese thought. This world view is, as Northrop has pointed out, essentially aesthetic in that it is a deeply felt appreciation of man's immersion in and harmony with nature; it is also, as Needham has shown, a thoroughly organic, holistic naturalism. It is sometimes difficult for the Westerner, whose concept of the universe is influenced by more theoretical considerations, to realize just how completely the Easterner feels himself a part of the intrinsic unity which is the cosmos.

It is this essential view which gives Chinese thought its spirit and force, and has made it possible for the *I Ching* to remain for so long a source of wisdom and social philosophy. The Book of Changes seems to have had an inexhaustible vitality, able to withstand abuse, misuse, crystallization, adulteration and indeed all the mishaps to which human structures of thought are subject. As both Wilhelms point out, the indestructibility of the *I Ching* lies in the fact that it represents a mirror of universal forces, a kind of cosmic reflection which endures so long as the forces themselves continue to play. It describes the relationship between heaven and earth; it describes equally the role of man in this ever-changing interplay. Thus it has specific experiential meaning for the individual. For the Chinese, the concatenation of circumstances which brings a human being to a certain point in space and time and relationship is not superficial or fortuitous; it is, rather, a process in which the whole universe participates. The hexagrams of the *I Ching* portray individual as well as general situations, because that which is within us engages with that which is without us in the continuum of nature.

In the Chinese view, the reasons for this are quite specific: they are based on the premise that the cosmos is in a state of continual change, and that only through acceptance of this principle can understanding be attained and life itself grasped. The change is not haphazard or unregulated; rather, the world is conceived as a system of orderly relationships -- a cosmos, not a chaos. Within the apparent duality of heaven and earth (which is in actuality a relation based on homogeneity, as in Indian philosophy) exists the possibility of every kind of movement and living expression of energy, all obeying definite laws. If in turn these laws are known, prediction is possible, and with it, freedom of action. Through movement that is self-contained and whole, as Hellmut Wilhelm says, the "infinite is brought within the confines of the finite, where alone it can be of service to man."

Today the West is learning more and more to appreciate the insights of the East, and to realize that there are other realities which have as much meaning for man as our own logical systems of thought. Even so, there are gaps in our understanding -- gaps which may be hard to fill quickly, and there is so little time. One of the biggest gaps for us lies all across the top of Asia, for China today is closed to us spiritually and intellectually as well as physically. Therefore books like the *I Ching* and Hellmut Wilhelm's perceptive commentary thereon have topical importance as well as intrinsic value. For through them one may penetrate the surface distortions of Chinese civilization, and glimpse the deep currents and springs which give it rise.

—E. B. Sellon

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF MAIN CURRENTS IN MODERN THOUGHT published five times a year in September, November, January, March and May at Port Chester, New York for October, 1960.

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